



NOAA / NWS Arctic Test Bed for Sea Ice and Weather Forecasting

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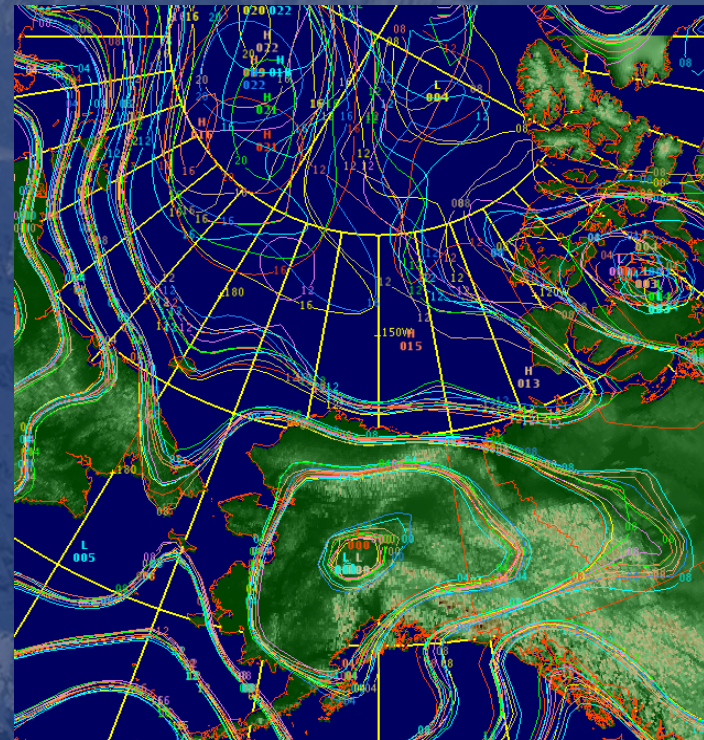


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Service Challenges

Lack of Observations and Science Understanding in the Arctic makes Weather, water, ocean, wave and sea ice forecasting very challenging

- Sea Ice Guidance
 - *Daily/Seasonal/Interannual*
 - *River Outflow & Sea Ice*
- Coastal Storms
 - *Inundation / Erosion*
 - *Waves in Sea Ice*
- Aviation Flight Safety
 - *Volcanic Ash*
 - *Arctic Stratus & Icing*
- Wildfire Fire Smoke
- General Forecast Processes
- Climate Change Impacts
 - *Adaptability (To What?)*



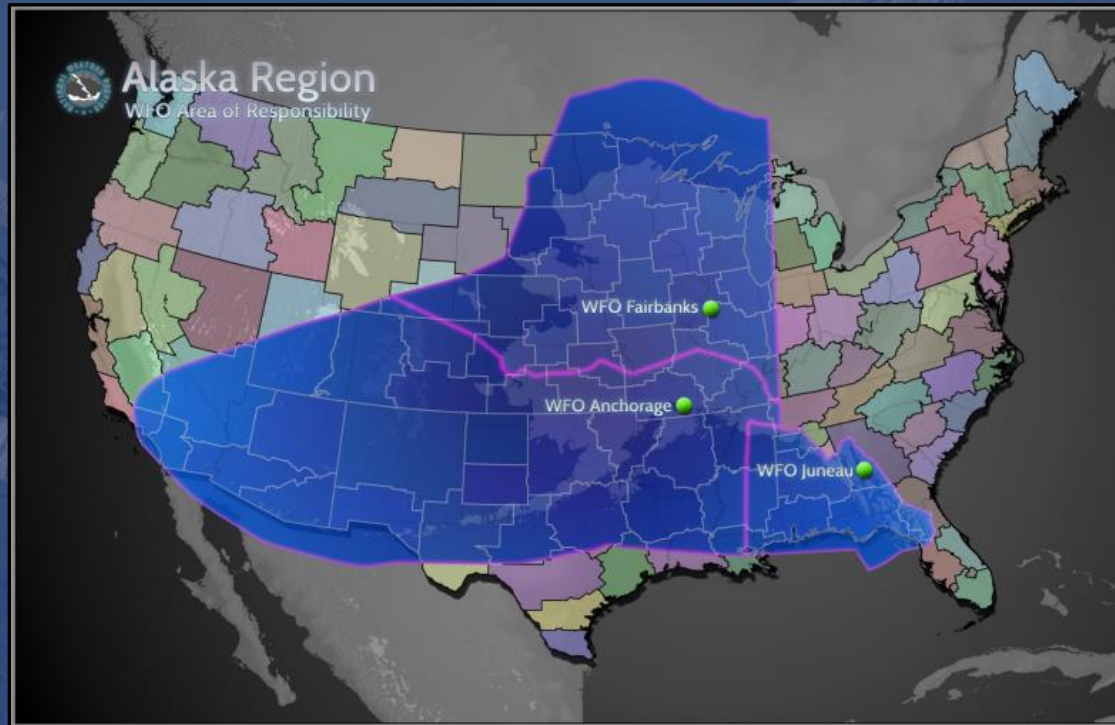
Societal Changes – How to Communicate with Diverse Groups?



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Customer Challenges

- With Rapidly Changing Sea Ice – Many New Emerging Customer Requirements



- Regulatory
- Emergency Response
- Supply Chain Management
- Resource Extraction
- Transportation
- Ecological

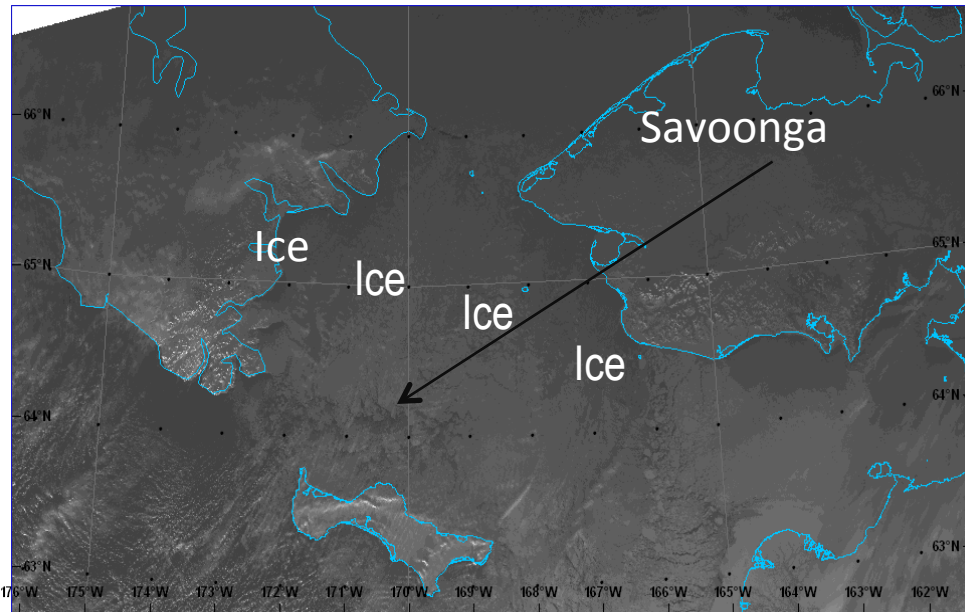
Area of Responsibility



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Weather and Sea Ice Challenges

Power Outage Savoonga December 26, 2010 – January 3, 2011

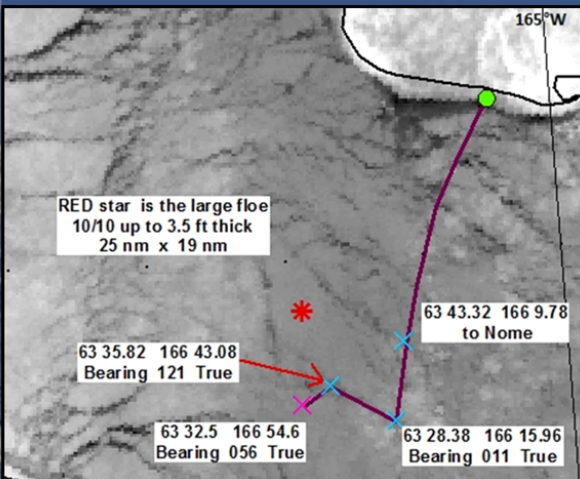


MODIS AQUA 29 DECEMBER 2010 0005Z

- Temperatures ranged from 5F to -10F with 30-50 mph winds
- The extreme cold caused the salt spray to freeze on electrical equipment. Though initial outages were caused by line slap from iced-up conductors, later problems were caused by electrical arcing through conductive salt
- **The lack of sea ice was a major contributor**
- Nearly $\frac{3}{4}$ of residents lost power over 6 days
- Weather hindered the ability to resupply food, plumbing supplies and repairmen

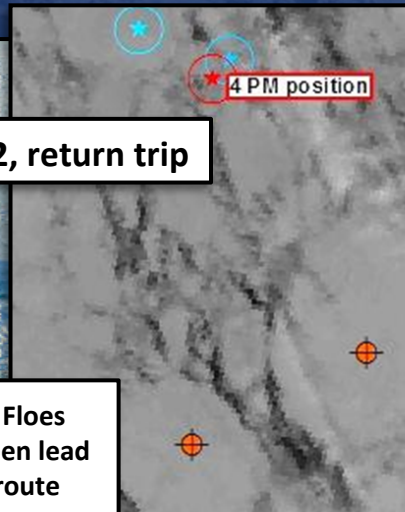
Nome Fuel Delivery – USCGC HEALY

December 2011 – January 2012



Jan 26, 2012, return trip

2 Large Ice Floes
closing an open lead
along the route



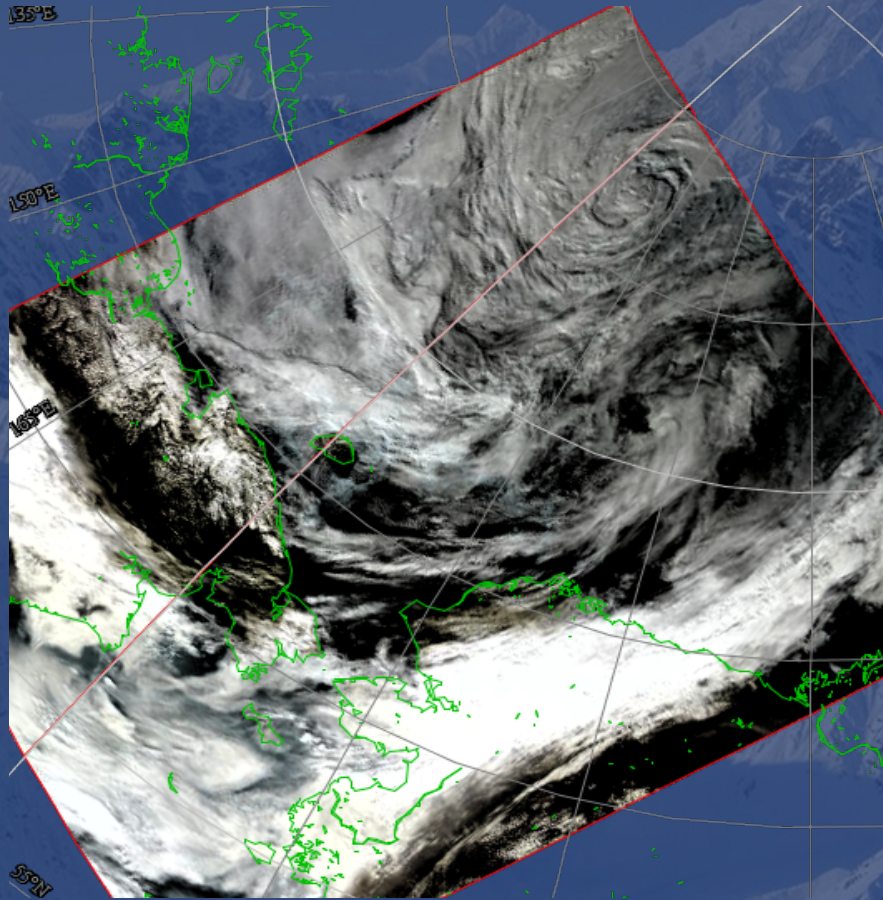
- Partnership between NWS Alaska and the NIC, and the Navy's Fleet Weather Center San Diego
- Scheduled fuel resupply in Nome delayed due to major storm, then scrubbed due to rapid sea ice development
- Successful support to USCG HEALY to assist Russian tanker mission to Nome, traveling through 865 miles sea ice up to 3 feet thick
- 46 consecutive days of support to USCG
 - Daily conference calls
 - Ice Briefings
 - Spot Ice Forecasts & Analysis
 - Annotated Satellite Imagery



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Weather and Sea Ice Challenges

Arctic Summer “Hurricane” August 1-4, 2012



- One of the strongest summer storms to have affected the Arctic Ocean in recent decades occurred in early August 2012.
- The storm’s central pressure was comparable to a Category-1 hurricane.
- The storm dispersed an already sparse ice cover, and waves from the storm propagated through the open water to the northern Alaskan coast, producing flooding in some villages.



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Weather and Sea Ice Challenges

F/V Kiska Sea Assist February 7 - 15, 2013



SNPP DNB Satellite Image from GINA

13 February 2013 at 1419Z

Northern Lights

F/V Kiska Sea

Ice Edge

Ice Edge

Crab Fleet

Dutch Harbor

7 Feb 2013

Strong Northerly winds cause rapid advance of ice pack

10 Feb 2013

150+ F/V Kiska Sea crab pots were deemed in danger of being overrun by sea ice

11 Feb 2013

F/V Kiska Sea captain and NWS Sea Ice Desk worked together to get pots back and return to ice free waters

12 Feb 2013

13 Feb 2013

F/V Kiska Sea surrounded by sea ice, some > 3' thick

15 Feb 2013

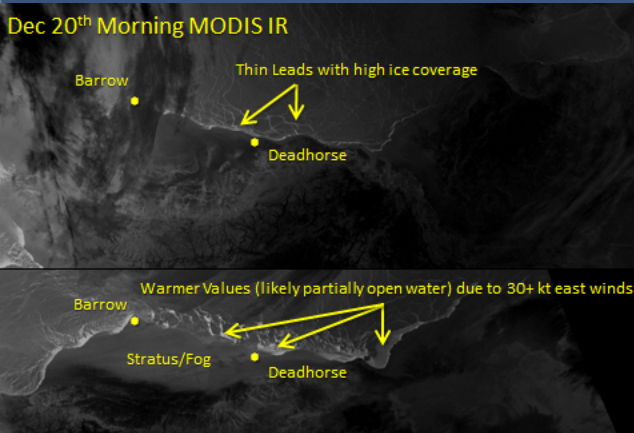
F/V Kiska Sea returns to ice free waters

- Day-Night Band (S-NPP) images from the previous night clearly showed the lights from F/V Kiska Sea and the ice pack around the vessel
- NWS Sea Ice personnel were able to assist the captain plot a track out of the ice pack, avoiding areas of thicker and higher concentration sea ice

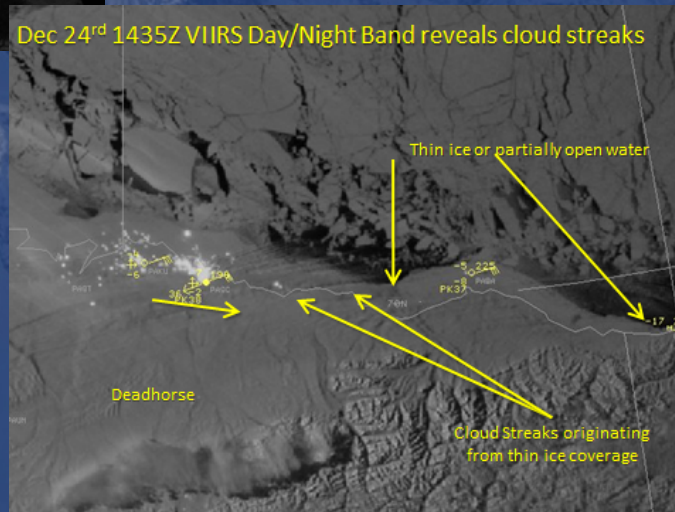
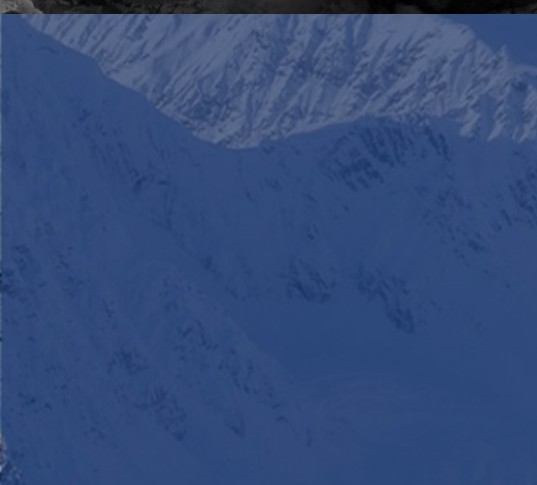
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Weather and Sea Ice Challenges

Aviation/Flight Safety December 20-23, 2014



Dec 23th Afternoon MODIS IR



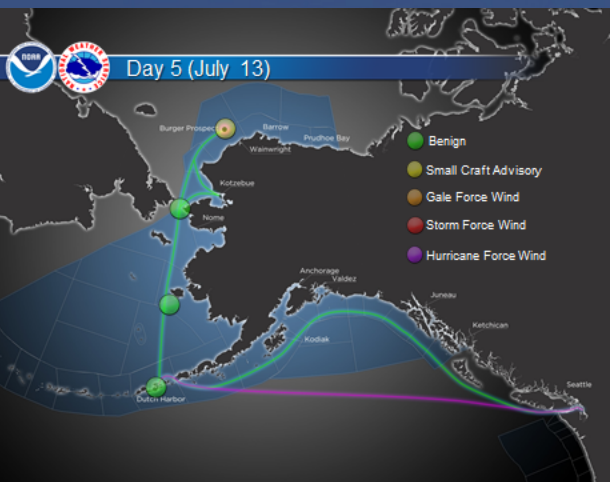
- While surface observations indicated low ceilings it wasn't clear if this was due to considerable blowing snow or actual clouds
- POES IR imagery clearly revealed warmer readings where winds and blowing snow were occurring, but didn't clearly discern if clouds were present
- Strong easterly winds broke up the sea ice and resulted in open or partially open water which seemed to enhance presence of low stratus/fog, clearly seen in S-NPP DNB imagery
- Later MODIS IR imagery (not shown) revealed that some of the more open water closed back a day after winds subsided (temperatures near 0 to -10F), which coincided with less coverage in clouds.



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Weather and Sea Ice Challenges

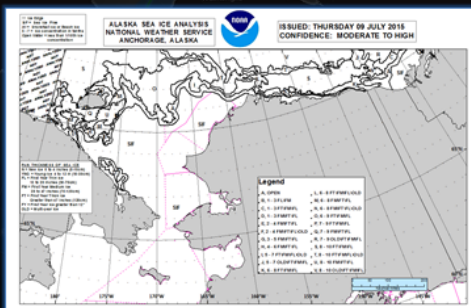
Support for BOEM (Shell Oil drilling in the Chukchi Sea) 2012 and 2015



- A partnership among NWS Alaska, NCEP/OPC and CPC and NOAA NIC
- Long range and tactical sea ice and weather forecasts focused on safe transit to and from the Burger Lease, probabilistic forecasts for freeze-up as well as safety of flight and navigation of ships and aircraft in theater of operations

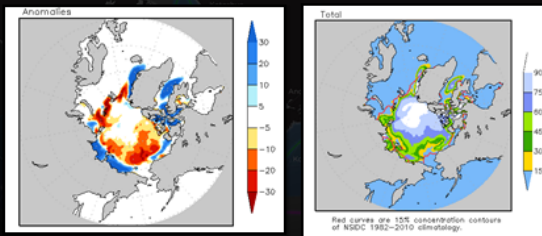
Present Sea Ice: July 08

Sea Ice Analysis: Burger prospect mostly ice free but low concentrations nearby



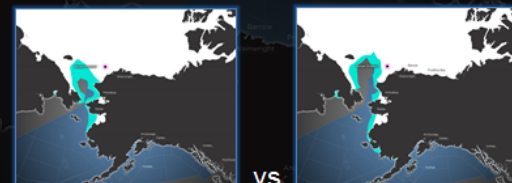
Sea Ice Outlook: Avg. extent in August

- Guidance indicates sea ice extent will be well north of the Burger Prospect for the month of August
- Trend since last week is for **less** ice north of Burger
- Model notoriously slow to retreat ice (over estimates)



* Experimental model is preferred – but not frequently available. We will compare operational and experimental when possible.

Sea Ice Outlook: Avg. extent in November



- "Operational" guidance shows average extent of sea ice in November to be beyond the Burger Site, and well into the Bering Strait Region
- "Experimental" guidance also shows average extent of sea ice in November beyond the Burger Site, though is less aggressive to form Sea Ice in the Bering Strait Region

Comparing the difference between the operational and experimental (preferred) sea ice outlook guidance. The graphics depict "average" extent of sea ice for the one-month period. *Guidance last updated mid June



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Potential Test Bed Activities

Evaluate Requirements for Providing Decision Support in the Arctic

What are the questions we are trying to answer?

What questions are most important to support Arctic Activities?

- Engage as Many User Groups as Possible
 - Government (Policy / Safety)
 - Transportation (Marine / Aviation)
 - Communities (Subsistence / Livelihood)
- Develop a Baseline of Requirements / Impact Thresholds:
 - What current information provides what is needed?
 - What are the gaps?
 - What are the questions new observation and models should be answering?



Freezing Spray, accumulated beyond the ice edge



Fishing for Ophelia Crab in the Bering Sea

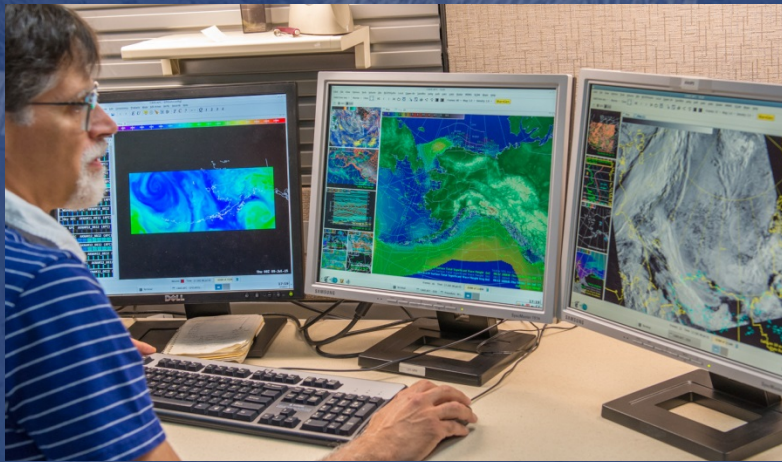


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Potential Test Bed Activities

Provide Forecast Services in support of Field Activities

NWS Alaska can provide observed and short and long term weather / ice forecast information in support of field programs and observation platform deployment activities within the Alaska Arctic AOR.



- Provides Invaluable Feedback between Project Field Operations and Forecasters
- Forecasts and Interactions will be Evaluated to Develop an IDSS Baseline
- Potential to Host Project Participants at the ATB as a operating base
- Potential for Collaboration with our Arctic Partner Forecast Facilities



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Groundwork

Vision Statement:

Formulate a Test Bed to improve Marine, Weather, Climate and Sea Ice forecasting decision support capability to meet expanding needs in the Arctic.

NOAA's Arctic Test Bed ensures that relevant operational scientific and technology advances are made to support the mandates of our core partners with weather, water, and climate information and predictions and associated impacts related to the people, infrastructure, and environment of Alaska and the Arctic.



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Test Bed Specifics

- Anchorage Forecast Facility
- Filling positions 2015- 2017
 - Director
 - 2 Research Meteorologists
 - 2 Science IT Developers
 - Service Delivery Meteorologist
 - NWS Forecasters to periodically rotate through
 - Visiting Scientist Opportunities
- Capabilities:
 - Integration with NWS forecast systems and data streams
 - Integration with research data streams

